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Refractive surgery

Many operations have been invented to correct refractive error. The cornea has been incised, lathed, frozen, burnt, sutured, and resected. Plastic lenses have been inserted into the cornea and clear non-cataractous lenses extracted. Few techniques have gained widespread approval. Intraocular lens implantation at the time of cataract extraction is a routine procedure and the commonest form of refractive surgery. Radial keratotomy and epikeratophakia account for most other cases.

One group of patients who may be candidates for refractive surgery is those in whom glasses or contact lenses provide good correction but who want to see without relying on these appliances. Patients have often read articles in the press and believe that refractive surgery is safe and predictable. In fact minor complications are common and major complications, although rare, include total loss of sight. Many ophthalmic surgeons consider that the benefits are not worth the risks, while others believe that after a full explanation the patient may make the final decision.

A second group who may benefit from surgery is those who may expect a better quality of vision than from either spectacles, which may distort or produce diplopia, or contact lenses, which may be tolerated only for short periods. The group includes those having lens implants at cataract surgery, aphakic patients requiring a secondary implant or epikeratophakia, patients with disablingly high astigmatism, and those with severe myopia.

Radial keratotomy can correct myopia from about -2 to -8 dioptres. Deep radial cuts, usually eight, are made in the cornea, sparing only the central 3 or 4 mm. Despite many formulas claiming to predict the degree of correction from preoperative values, the procedure is unpredictable.[1] One trial showed that while the average predicted change was 3·56 dioptres the 90% confidence interval extended from 1·85 to 5·27 dioptres.[2] Patient satisfaction is more related, however, to uncorrected visual acuity than to the refractive result; overcorrected patients simply accommodate to overcome their induced long sight. Most trials find that between 70% and 90% of patients achieve an uncorrected visual acuity of 6/12 or better, and almost every patient reports a worthwhile improvement.[3]

With the onset of presbyopia at about 45 most patients with myopia learn that they can read without spectacles. Patients who have had radial keratotomy will need reading glasses, and if overcorrected they will also need distance correction. In effect such patients have traded a period of good uncorrected vision for a later increased need for spectacles.

Troublesome glare occurs in about one third of patients and is occasionally disabling.[4,5] Important diurnal fluctuation of refraction also occurs in about one third of patients,[4] probably because of failure of the avascular cornea to heal. Eyes that have had radial keratotomy are permanently weakened, and blunt trauma could theoretically rupture the incisions.[6] Rare complications include inadvertent perforation of the eye and late problems such as the breakdown of unstable epithelium leading to a recurrent erosion or corneal abscess.

About 5% of Britons have myopia in the range treatable by radial keratotomy. Those who inquire about surgery should be told about the unpredictability of the result, the complications of glare and diurnal fluctuation, and the permanent loss of corneal strength that occurs. They should also be warned that vision may be lost. Patients who request surgery to enable them to reach an employer's standard of uncorrected vision should be warned that some employers now specifically exclude potential employees who have had refractive surgery.

Epikeratophakia can correct refractive error from about -25 dioptres to $+25$ dioptres. A frozen donor cornea is lathed to the shape of a contact lens. Relatively non-invasive surgery is then performed: surface epithelium is removed from the cornea, and a superficial groove trephined peripherally. The lathed lens is then sewn on top of the patient's cornea, tucking its edge into this superficial groove. Postoperatively corneal epithelium grows over the lathed lens and keratocytes from the patient migrate into the lathed lens (whose own cells are killed by the cryolathing). Unlike with a conventional corneal graft, rejection is not a problem.

One drawback of epikeratophakia is that good visual acuity takes time to develop, but by four months about four fifths of patients are within one Snellen line of their best potential acuity.[7] The final corrected visual acuity is limited by the increased thickness of cornea and the extra interface and may not equal the best corrected preoperative value. Overall about three quarters of patients are corrected within 3 dioptres of the intended refraction.[7,8] The procedure is thus not suitable for low refractive errors: the aim is to reach a refraction that can be comfortably corrected with glasses.

Epikeratophakia is safe. If inaccurate refraction or other complications occur, then the lathed lens can be removed leaving the patient's cornea more or less undamaged. This is necessary in between 4% and 10% of cases.[7,8]

Epikeratophakia is suitable for patients with aphakia in whom lens implantation is contraindicated and a trial of contact lens wear has failed. It is particularly suitable for patients with monocular aphakia, who might have intolerable diplopia with glasses. The use of epikeratophakia for patients with congenital cataract is still experimental, and contact lenses seem better, although operations have been performed on children under 1 year.[9] Patients with severe myopia experience image distortion with glasses, and should genuine contact lens intolerance occur then the patient may benefit from epikeratophakia.[8]

There are likely to be important changes in refractive surgery. Development of the excimer laser, which can vaporise corneal tissue precisely with minimal effect on surrounding tissue, may make radial keratotomy obsolete in the next decade. Laboratory manufactured lenses for epikeratophakia may overcome the problems of using biologically variable donor tissue.

Refractive surgery is major surgery. Patients must understand that an operation will not improve their best corrected visual acuity and that complications may occur.

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Changing the law on children in cars

People would not carry eggs, it has been said, as they so often carry children in the rear seats of cars—unrestrained and much less secure than their parents in the front. Yet children have been found to suffer head and face injuries far more commonly than unrestrained adults; in particular, young children with their light weight become high velocity missiles and may be thrown on to the road, a rare occurrence in those who are restrained.

In 1986, says the Transport and Road Research Laboratory, 8560 children under 14 were injured in the rear of cars and light vans, 89% of the child casualties in these vehicles; 67 died and 940 were seriously injured. According to the laboratory, using restraints correctly reduces deaths by around three quarters in children under 5; and American studies suggest reductions of 80-90% in fatal and serious injury to children. But only 37% of children use restraints, and only 31% of children in the rear—55% of babies and progressively fewer older children.[1] Children aged 5-13 have 65% of the child casualties but only 17% use restraints. Improvement here would pay particular dividends, but, as with front seat belts, progress is slow without legislation.

The government has so far refused to introduce legislation on the retrospective fitting of rear belts in cars with anchorage points only, manufactured between October 1981 and October 1986. Now as a first step a private member's bill, with all party support, is to be introduced by Mr Stephen Day. This requires the use of restraints, if seat belts are fitted in the rear, by children under 14. This may not seem much; but, although only three million cars at most have rear belts, the proportion will increase (nearly 10% of the 19 million cars were new last year). Even this bill, according to cautious estimates, could prevent about 50 serious and fatal injuries a year now, rising to around 350.

Compulsory restraint of children in cars has been successfully introduced in The Netherlands; Australia, New Zealand, Canada, and the United States. According to information gathered by the Parliamentary Advisory Council for Transport Safety, injuries have fallen by up to half after legislation. Belatedly Britain must follow their example. In a recent Gallup poll 91% of drivers supported the compulsory use of restraints for children in the rear of cars. Doctors could support the bill by writing to their members of parliament and to the press, for many can attest to the terrible and unnecessary injuries that children still suffer.

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1 Transport and Road Research Laboratory. *Restraint use by children: 1982-1986.* Crowthorne: Transport and Road Research Laboratory, 1987. (Leaflet LF 1037.)

Child abuse and osteogenesis imperfecta

One diagnosis in children, particularly babies, who suffer unexplained fractures is osteogenesis imperfecta—"brittle bones disease." Babies suspected of having been non-accidentally injured may be claimed to have "brittle bones." How great is the risk of confusion?

Osteogenesis imperfecta is not a homogeneous condition but comprises at least four main varieties subdivided into various subtypes.[1,2] All appear to result from different genetically determined abnormalities of connective tissue, particularly type I precollagen.[3-5] Thus tissues other than bone may be affected. Controversy continues over the genetics of osteogenesis imperfecta, but the commonest form, accounting for about 80% of cases,[6] is an autosomal dominant disorder (type I)[7] almost invariably associated with blue sclerae.[8] There are two probably autosomal recessive forms of the disease: the first (type II osteogenesis imperfecta) is extremely severe with multiple fractures at birth and early death; and type III is similar to type II but less severe. A fourth and rare form of the disorder (type IV) is autosomal dominant with occasional spontaneous mutations. It tends to be intermediate in severity, but most cases appear to be severe enough to be difficult to distinguish from type III.